FIG. 1A

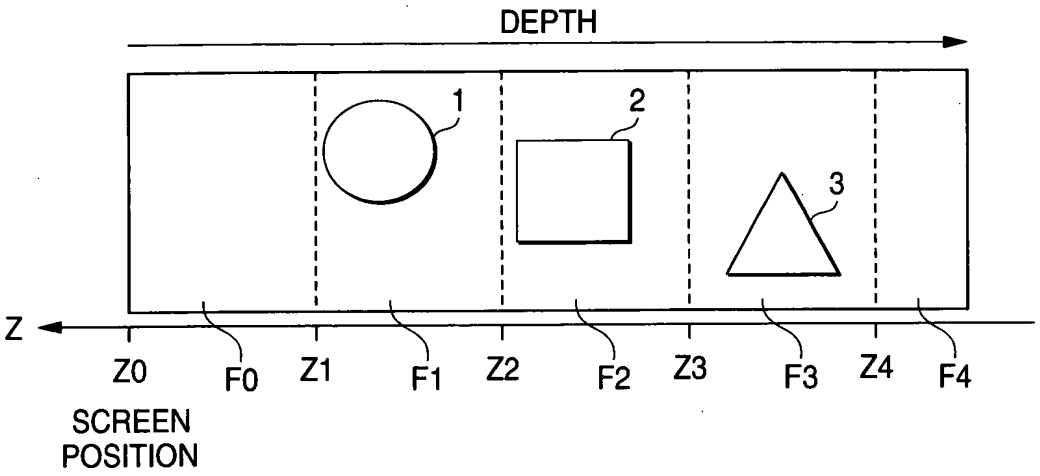
DEPTH
1
2
3
Z
Z0
F0
Z1
F1
Z2
F2
Z3
F3
Z4
F4
SCREEN
POSITION

FIG. 1B

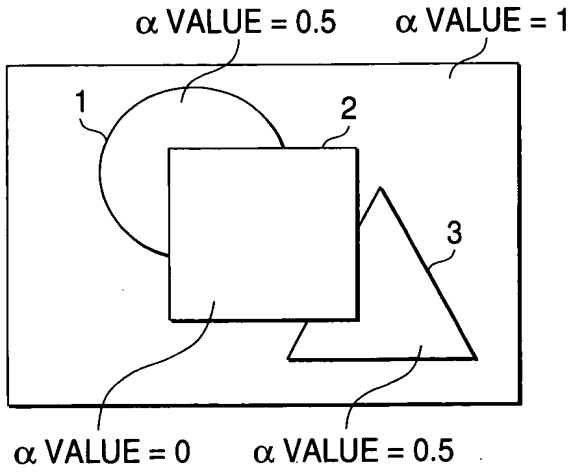
α VALUE = 0.5
α VALUE = 1
1
2
3
α VALUE = 0
α VALUE = 0.5

FIG. 2

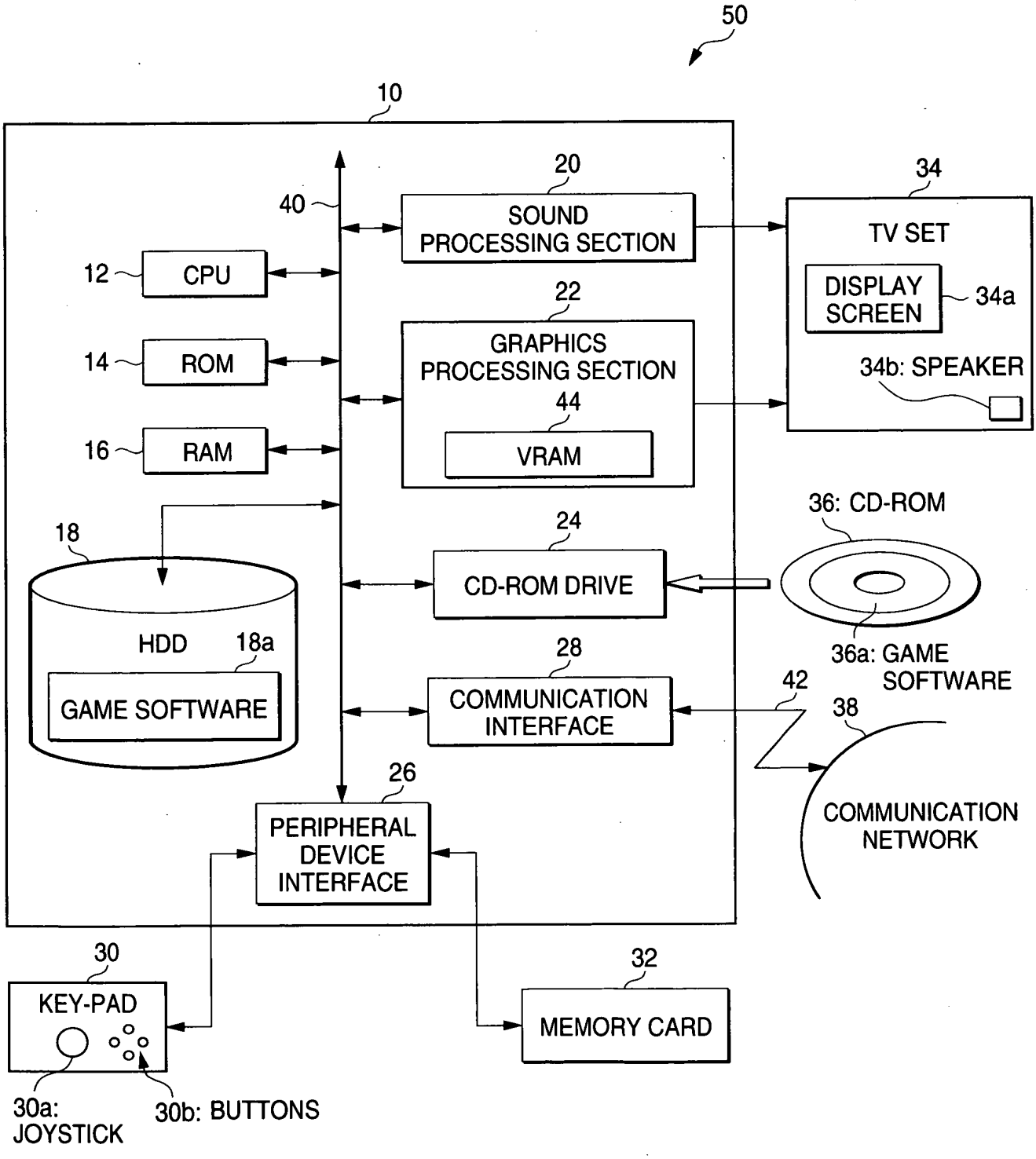
50
10
20
SOUND PROCESSING SECTION
40
34
TV SET
DISPLAY SCREEN
34a
34b: SPEAKER
12
CPU
22
GRAPHICS PROCESSING SECTION
44
VRAM
14
ROM
16
RAM
18
HDD
18a
GAME SOFTWARE
24
CD-ROM DRIVE
36: CD-ROM
36a: GAME SOFTWARE
28
COMMUNICATION INTERFACE
42
38
COMMUNICATION NETWORK
26
PERIPHERAL DEVICE INTERFACE
30
KEY-PAD
32
MEMORY CARD
30a: JOYSTICK
30b: BUTTONS

FIG. 3

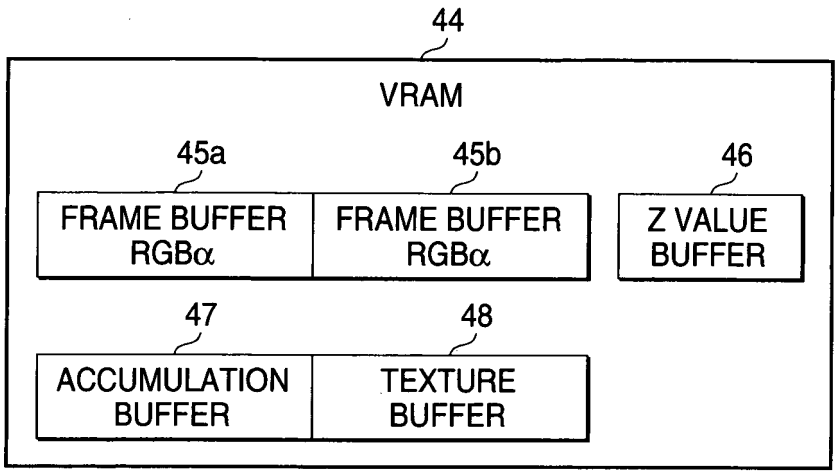
44
VRAM
45a
45b
46
FRAME BUFFER RGBα
FRAME BUFFER RGBα
Z VALUE BUFFER
47
48
ACCUMULATION BUFFER
TEXTURE BUFFER

FIG. 4

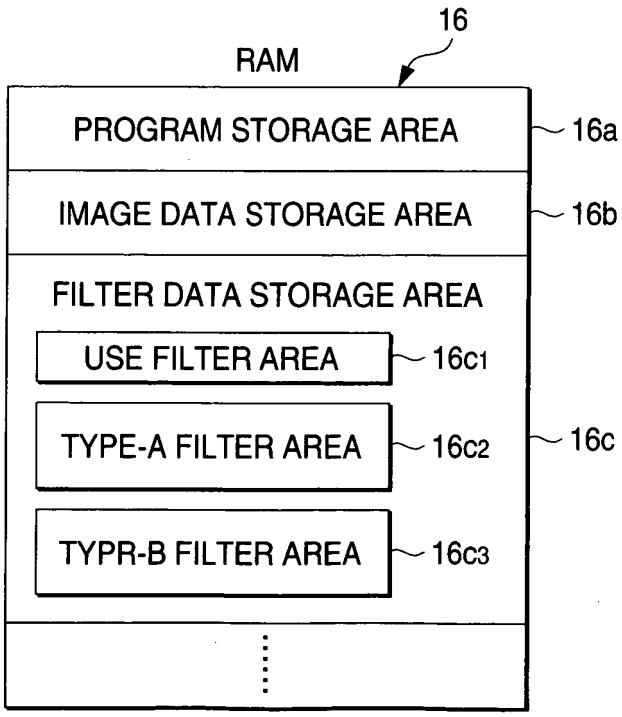
16
RAM
PROGRAM STORAGE AREA
16a
IMAGE DATA STORAGE AREA
16b
FILTER DATA STORAGE AREA
USE FILTER AREA
16c1
TYPE-A FILTER AREA
16c2
16c
TYPR-B FILTER AREA
16c3

FIG. 5A

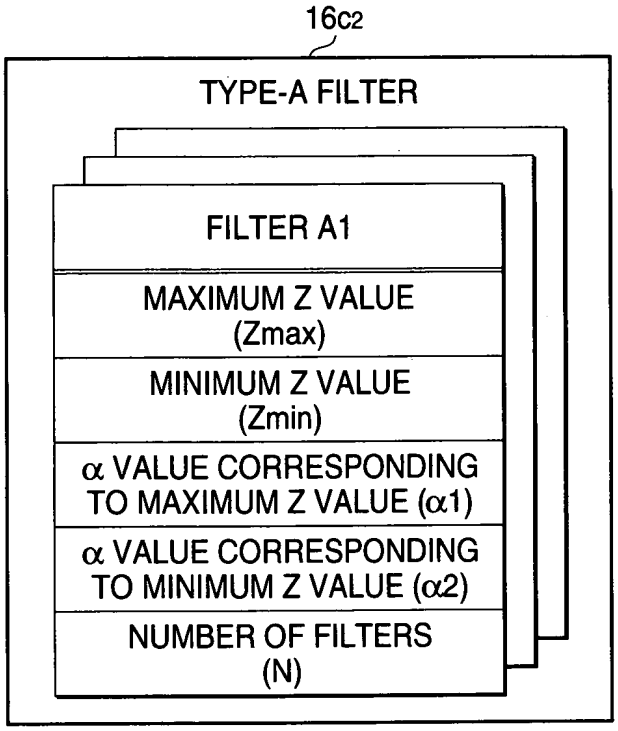
16c2
TYPE-A FILTER
FILTER A1
MAXIMUM Z VALUE (Zmax)
MINIMUM Z VALUE (Zmin)
α VALUE CORRESPONDING TO MAXIMUM Z VALUE (α1)
α VALUE CORRESPONDING TO MINIMUM Z VALUE (α2)
NUMBER OF FILTERS (N)

FIG. 5B

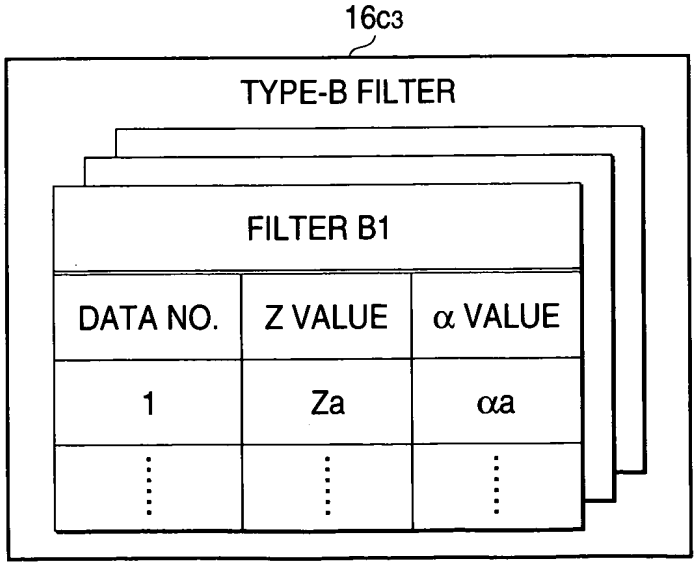
16c3
TYPE-B FILTER
FILTER B1
DATA NO.
Z VALUE
α VALUE
1
Za
αa

FIG. 6

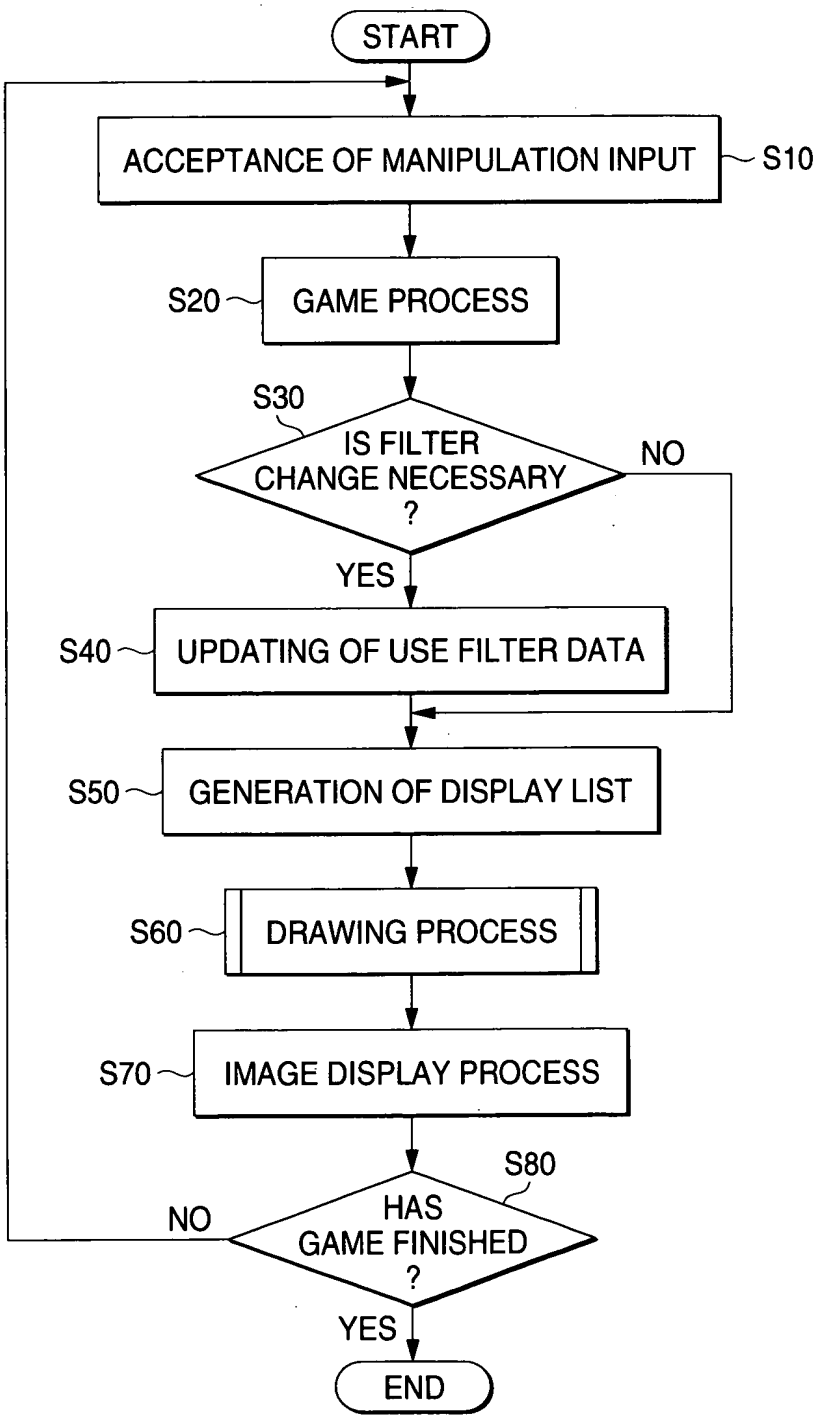
START
ACCEPTANCE OF MANIPULATION INPUT
S10
S20
GAME PROCESS
S30
IS FILTER CHANGE NECESSARY ?
NO
YES
S40
UPDATING OF USE FILTER DATA
S50
GENERATION OF DISPLAY LIST
S60
DRAWING PROCESS
S70
IMAGE DISPLAY PROCESS
S80
HAS GAME FINISHED ?
NO
YES
END

FIG. 7

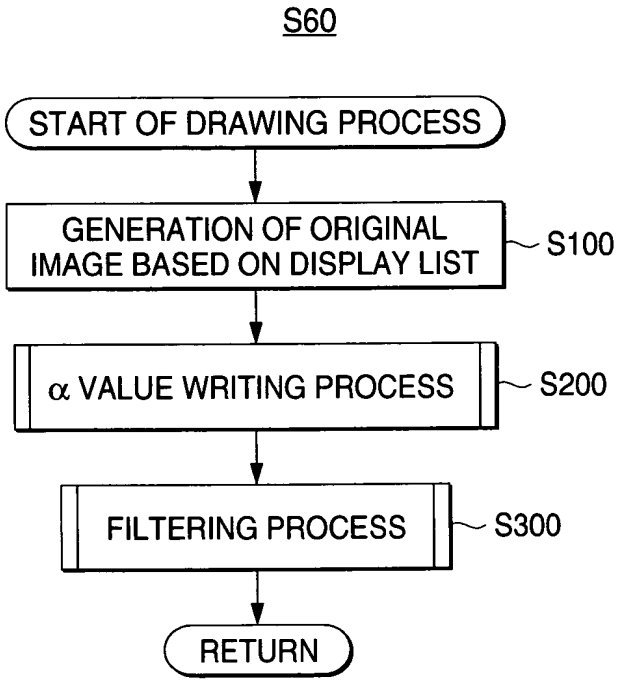

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FIG. 8

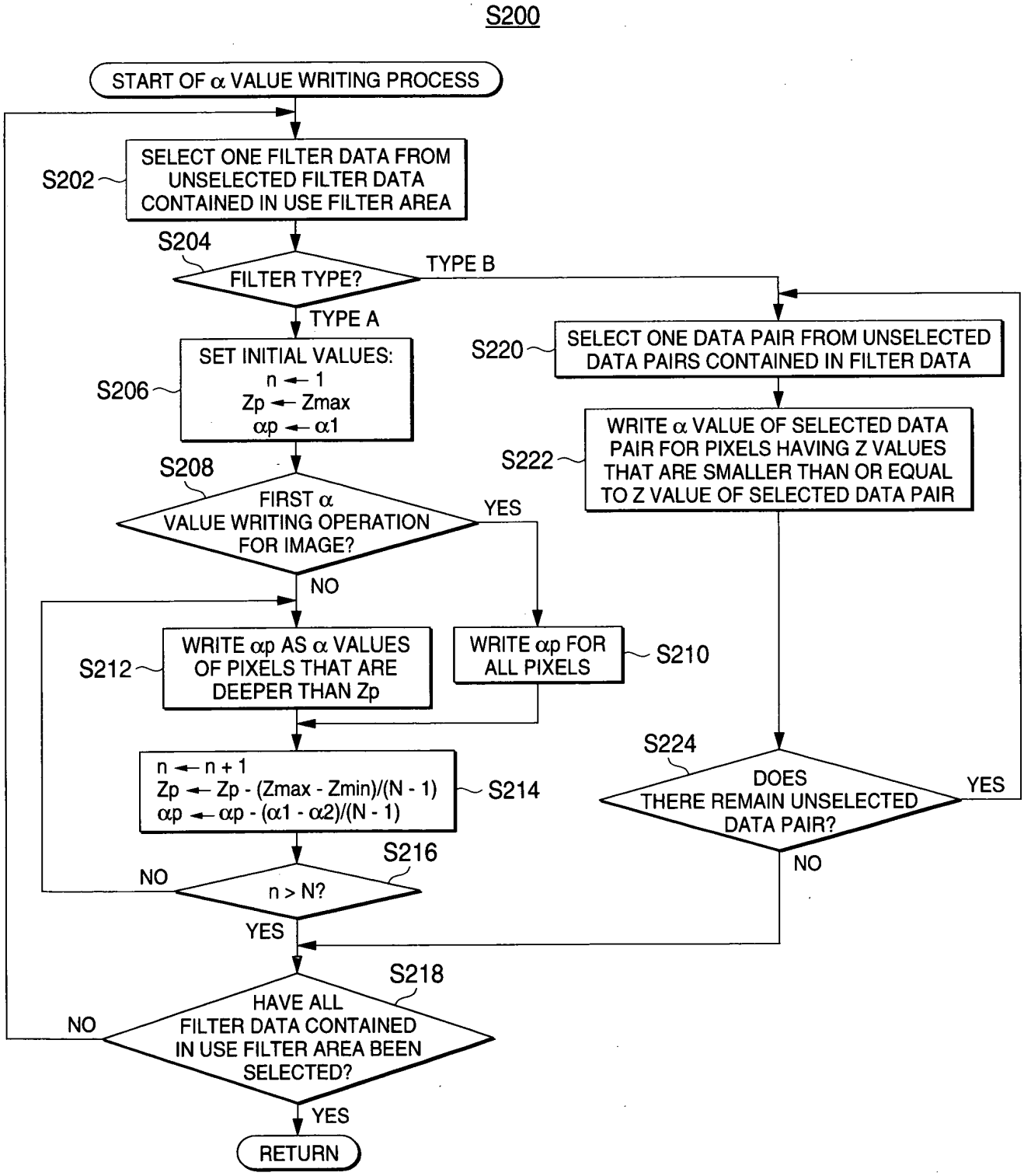
S200
START OF α VALUE WRITING PROCESS
S202
SELECT ONE FILTER DATA FROM UNSELECTED FILTER DATA CONTAINED IN USE FILTER AREA
S204
FILTER TYPE?
TYPE B
TYPE A
S206
SET INITIAL VALUES:
n ← 1
Zp ← Zmax
αp ← α1
S208
FIRST α VALUE WRITING OPERATION FOR IMAGE?
YES
NO
S212
WRITE αp AS α VALUES OF PIXELS THAT ARE DEEPER THAN Zp
WRITE αp FOR ALL PIXELS
S210
n ← n + 1
Zp ← Zp - (Zmax - Zmin)/(N - 1)
αp ← αp - (α1 - α2)/(N - 1)
S214
S216
n > N?
NO
YES
S218
HAVE ALL FILTER DATA CONTAINED IN USE FILTER AREA BEEN SELECTED?
NO
YES
RETURN
S220
SELECT ONE DATA PAIR FROM UNSELECTED DATA PAIRS CONTAINED IN FILTER DATA
S222
WRITE α VALUE OF SELECTED DATA PAIR FOR PIXELS HAVING Z VALUES THAT ARE SMALLER THAN OR EQUAL TO Z VALUE OF SELECTED DATA PAIR
S224
DOES THERE REMAIN UNSELECTED DATA PAIR?
YES
NO

FIG. 9A

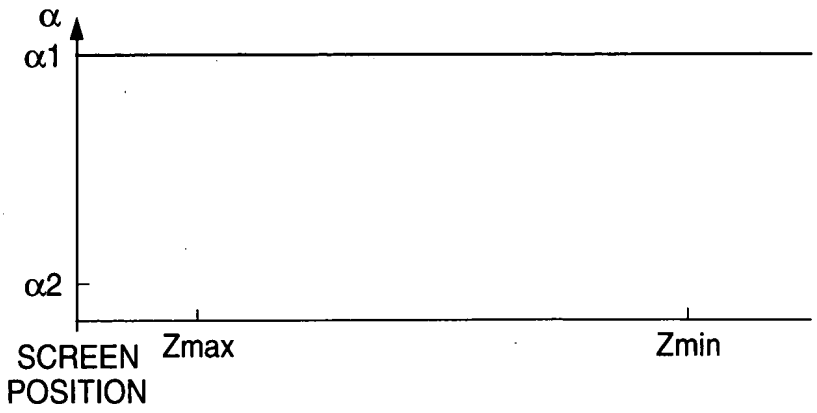

FIG. 9B

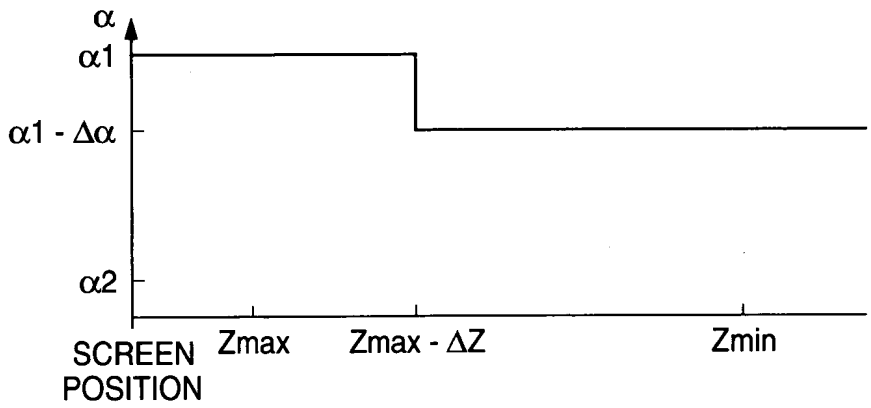

FIG. 9C

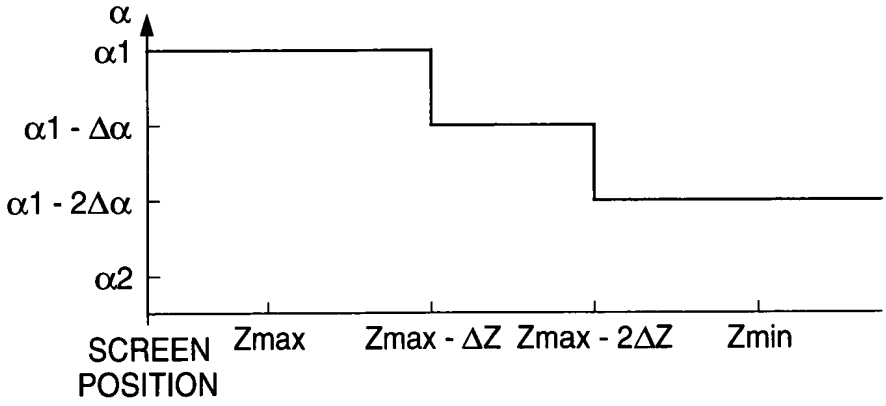

FIG. 9D

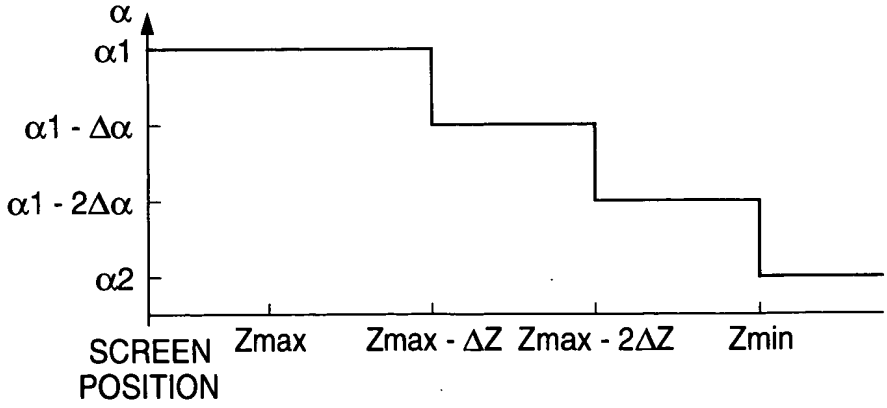

FIG. 10A

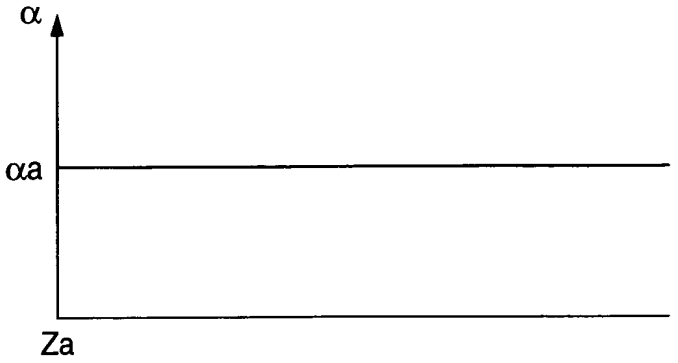

FIG. 10B

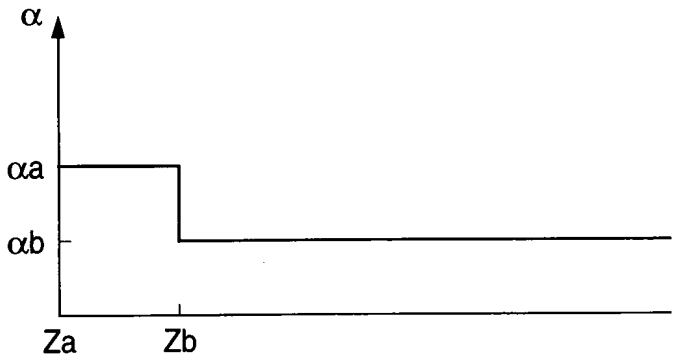

FIG. 10C

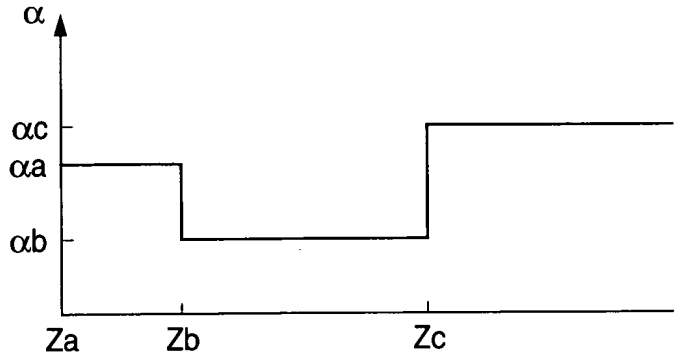

FIG. 10D

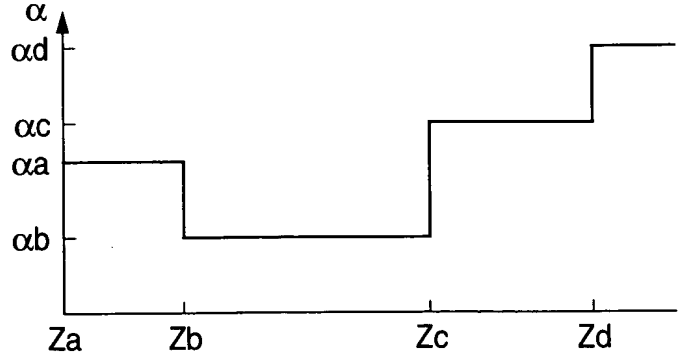

FIG. 11A

FILTER B10		
NO.	Z VALUE	α VALUE
1	Z0	1
2	Z1	0.5
3	Z2	0
4	Z3	0.5
5	Z4	1

FIG. 11B

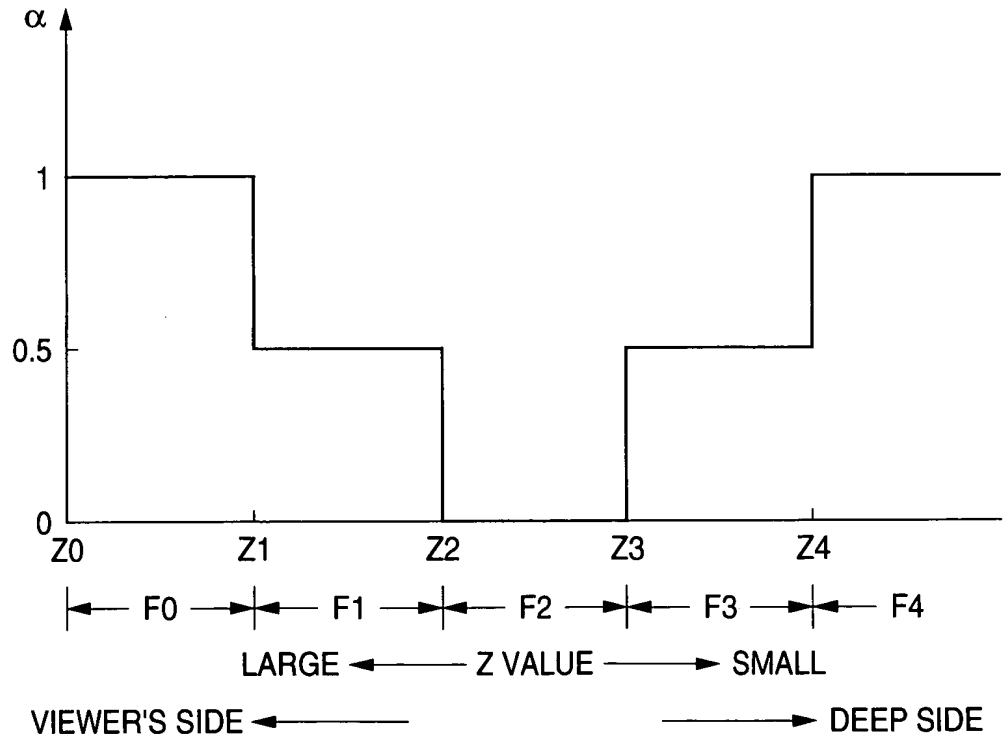

FIG. 12A

FILTER A10
Zmax = Z0
Zmin = Z14
α1 = 0
α2 = 0
N = 5

FIG. 12B

FILTER A11
Zmax = Z15
Zmin = Z18
α1 = 0.25
α2 = 1
N = 4

FIG. 12C

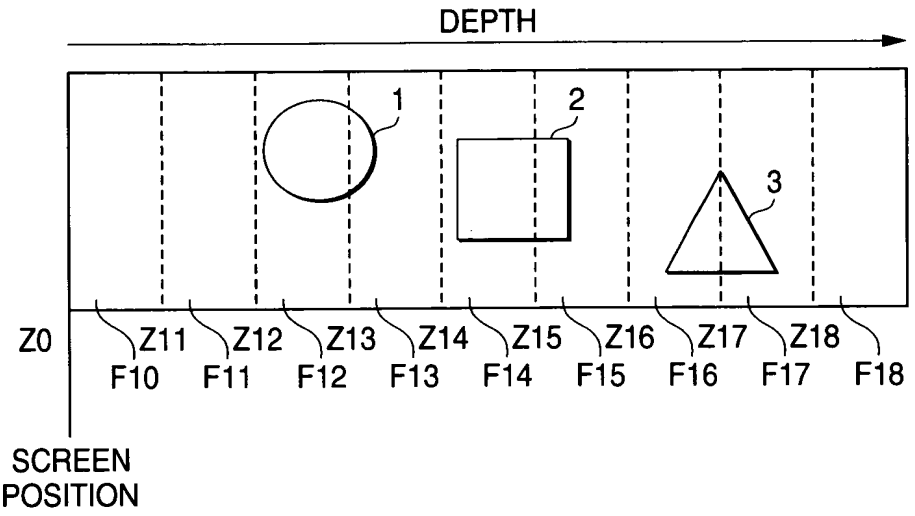

FIG. 12D

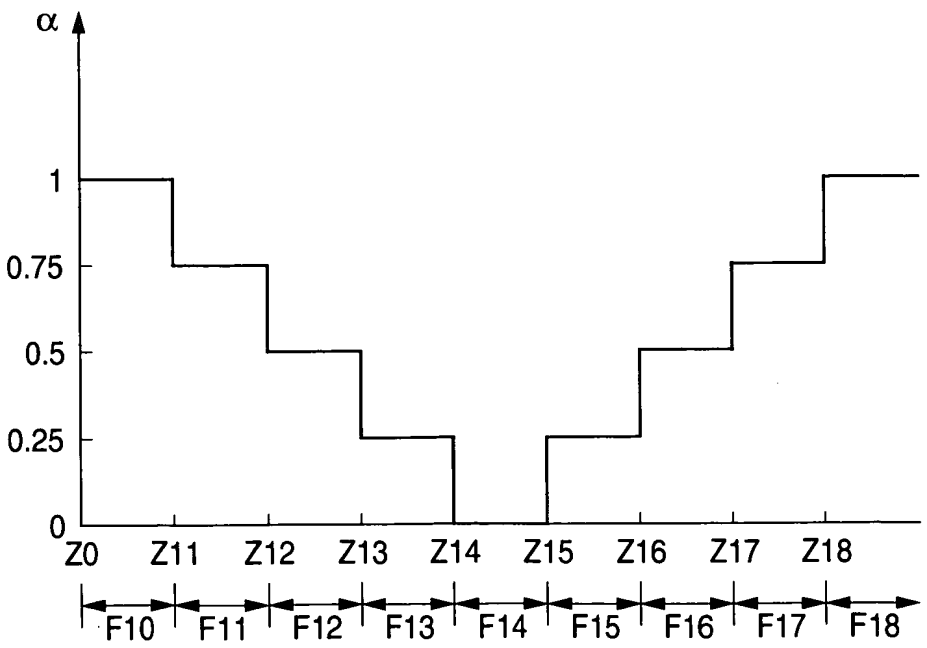

FIG. 13A

FILTER A20
Zmax = Z0
Zmin = Z22
α1 = 1
α2 = 0
N = 3

FIG. 13B

FILTER B20		
NO.	Z VALUE	α VALUE
1	Z23	0.5
2	Z24	1

FIG. 13C

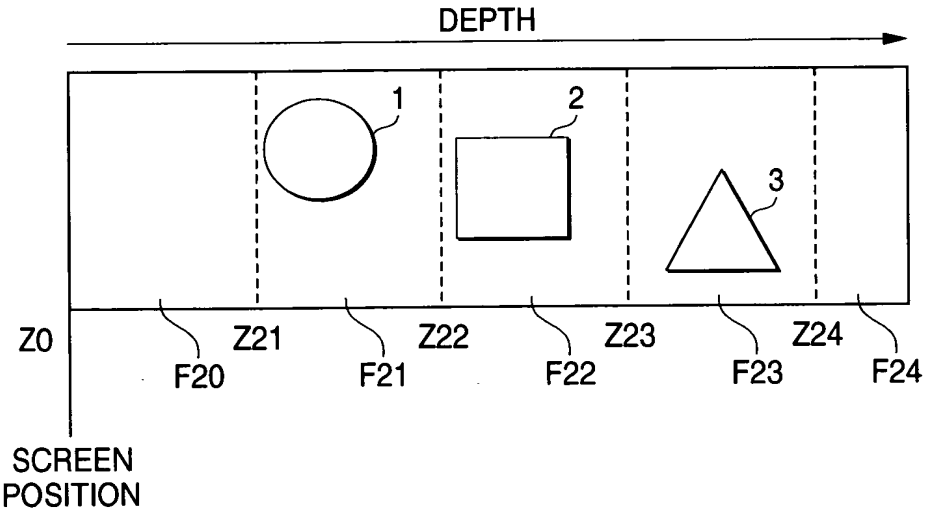

FIG. 13D

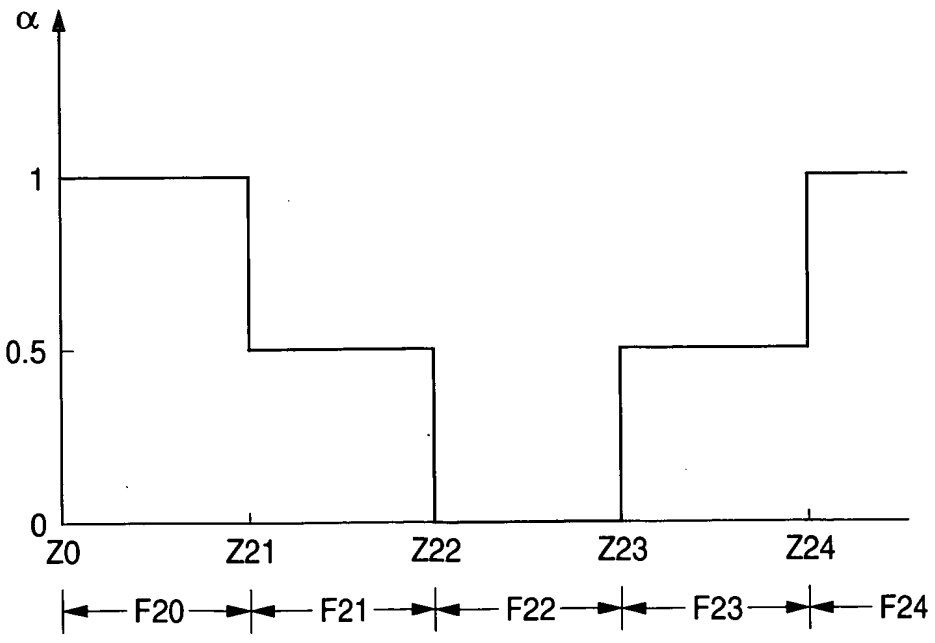

FIG. 14

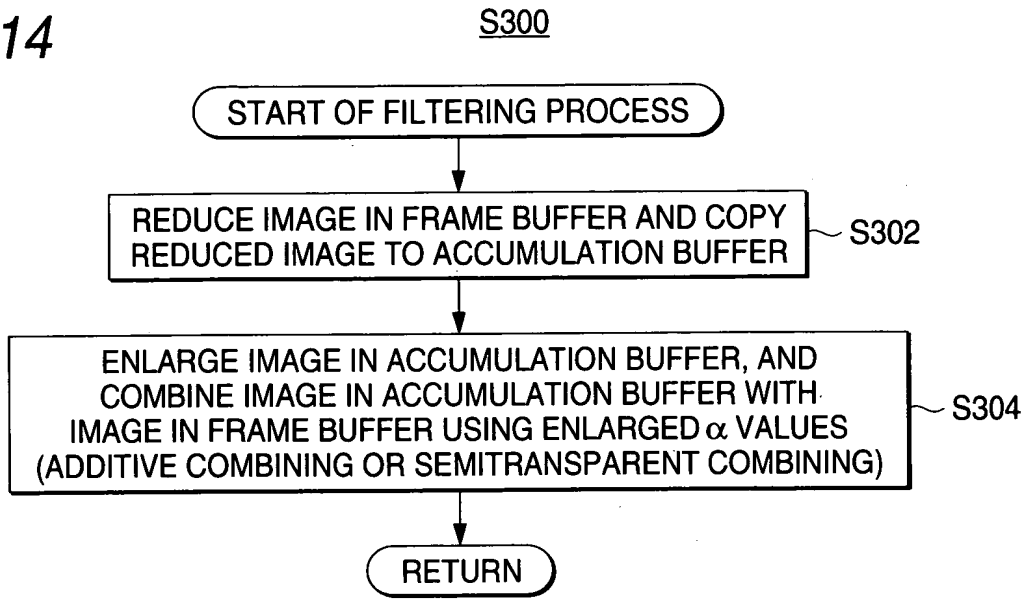
S300
START OF FILTERING PROCESS
REDUCE IMAGE IN FRAME BUFFER AND COPY REDUCED IMAGE TO ACCUMULATION BUFFER
S302
ENLARGE IMAGE IN ACCUMULATION BUFFER, AND COMBINE IMAGE IN ACCUMULATION BUFFER WITH IMAGE IN FRAME BUFFER USING ENLARGED α VALUES (ADDITIVE COMBINING OR SEMITRANSPARENT COMBINING)
S304
RETURN

FIG. 15

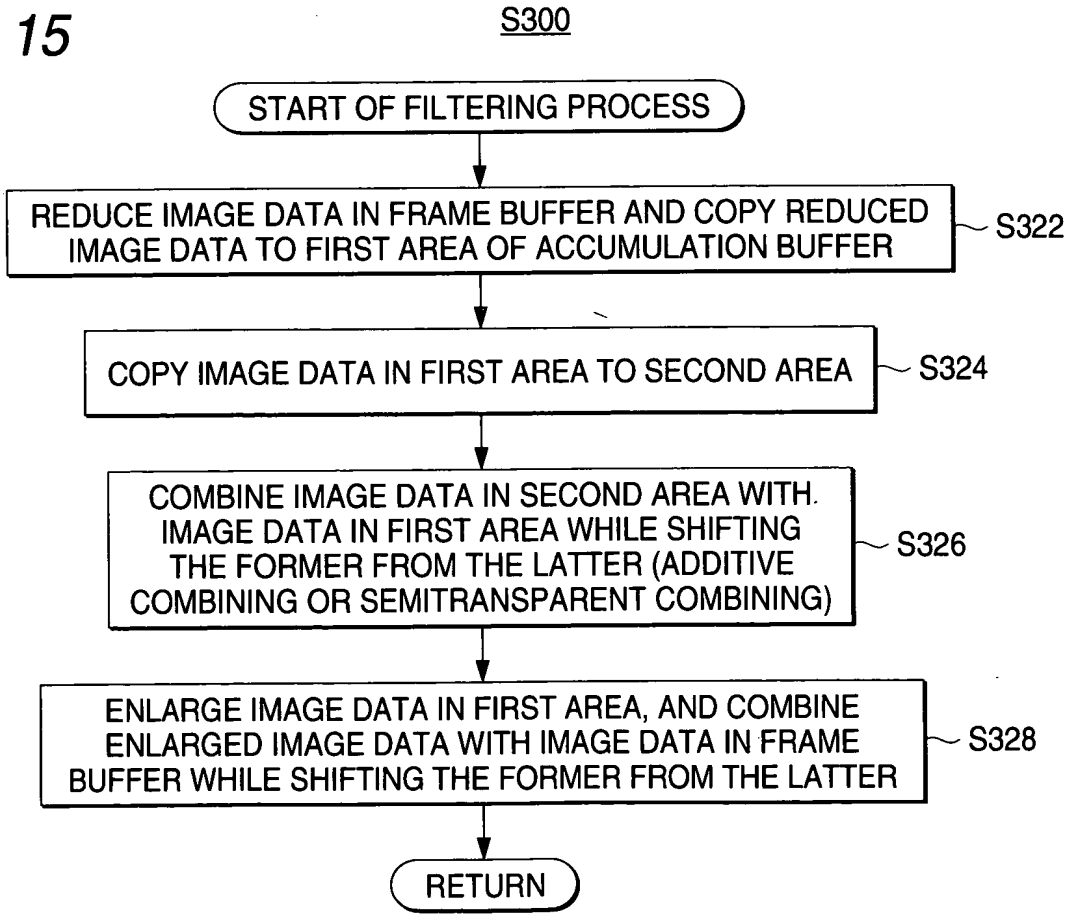
S300
START OF FILTERING PROCESS
REDUCE IMAGE DATA IN FRAME BUFFER AND COPY REDUCED IMAGE DATA TO FIRST AREA OF ACCUMULATION BUFFER
S322
COPY IMAGE DATA IN FIRST AREA TO SECOND AREA
S324
COMBINE IMAGE DATA IN SECOND AREA WITH IMAGE DATA IN FIRST AREA WHILE SHIFTING THE FORMER FROM THE LATTER (ADDITIVE COMBINING OR SEMITRANSPARENT COMBINING)
S326
ENLARGE IMAGE DATA IN FIRST AREA, AND COMBINE ENLARGED IMAGE DATA WITH IMAGE DATA IN FRAME BUFFER WHILE SHIFTING THE FORMER FROM THE LATTER
S328
RETURN

FIG. 16

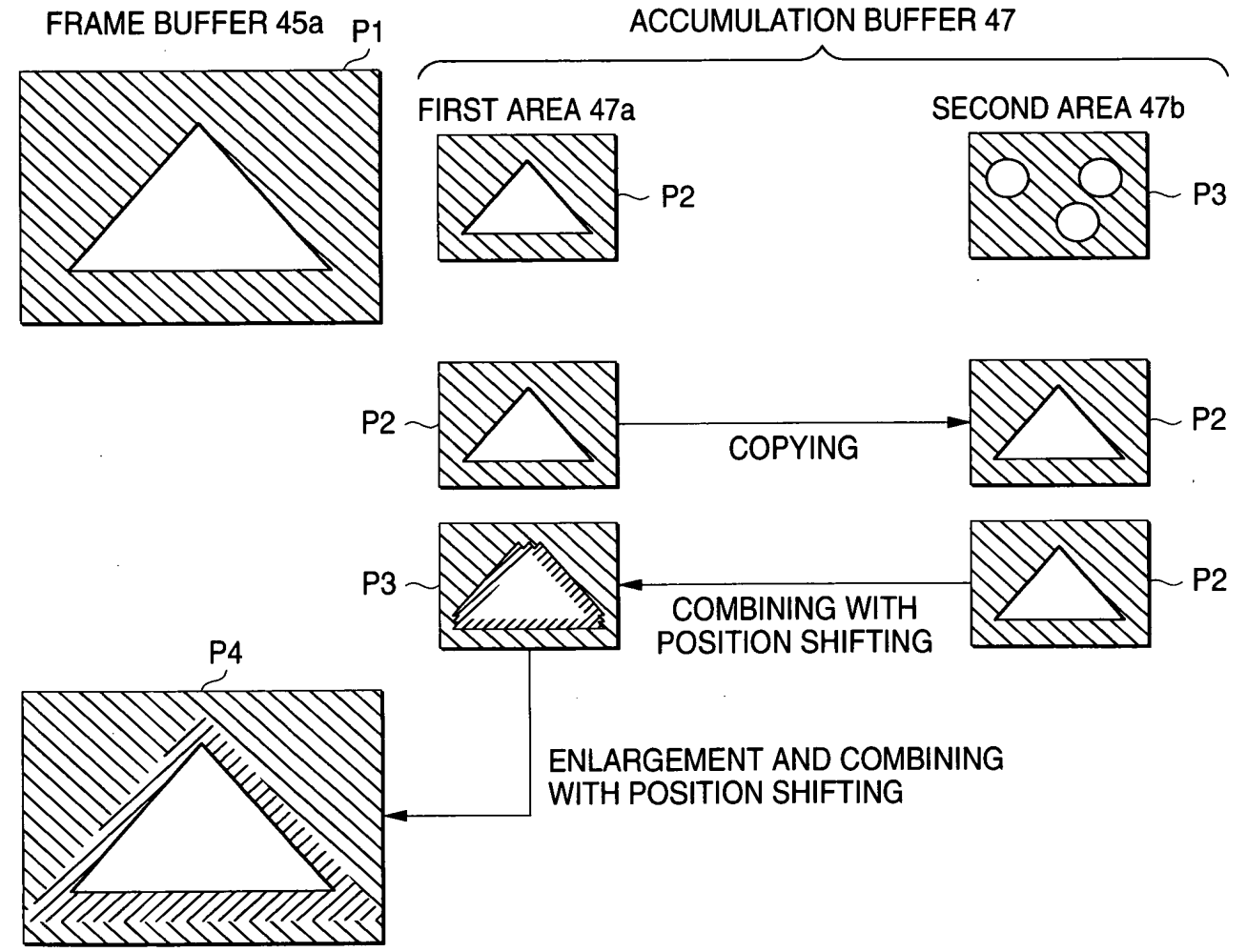
FRAME BUFFER 45a
P1
ACCUMULATION BUFFER 47
FIRST AREA 47a
SECOND AREA 47b
P2
P3
P2
COPYING
P2
P3
COMBINING WITH
POSITION SHIFTING
P2
P4
ENLARGEMENT AND COMBINING
WITH POSITION SHIFTING

FIG. 17A

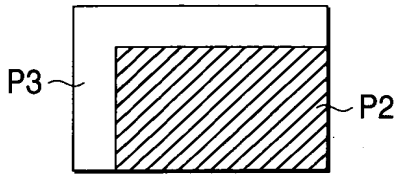

FIG. 17B

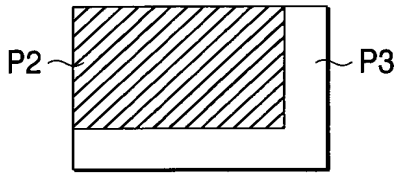

FIG. 17C

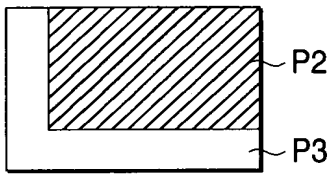

FIG. 17D

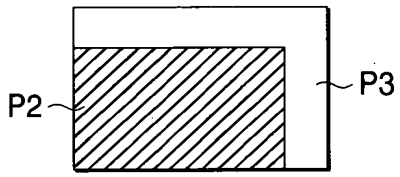

FIG. 17E

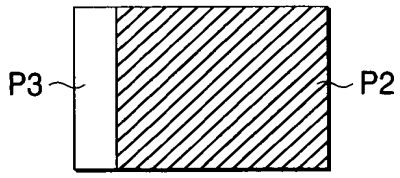

FIG. 17F

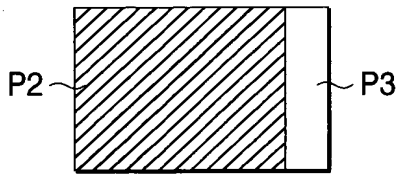

FIG. 17G

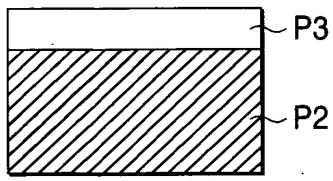

FIG. 17H

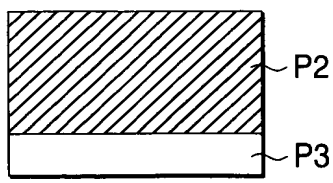

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FIG. 18

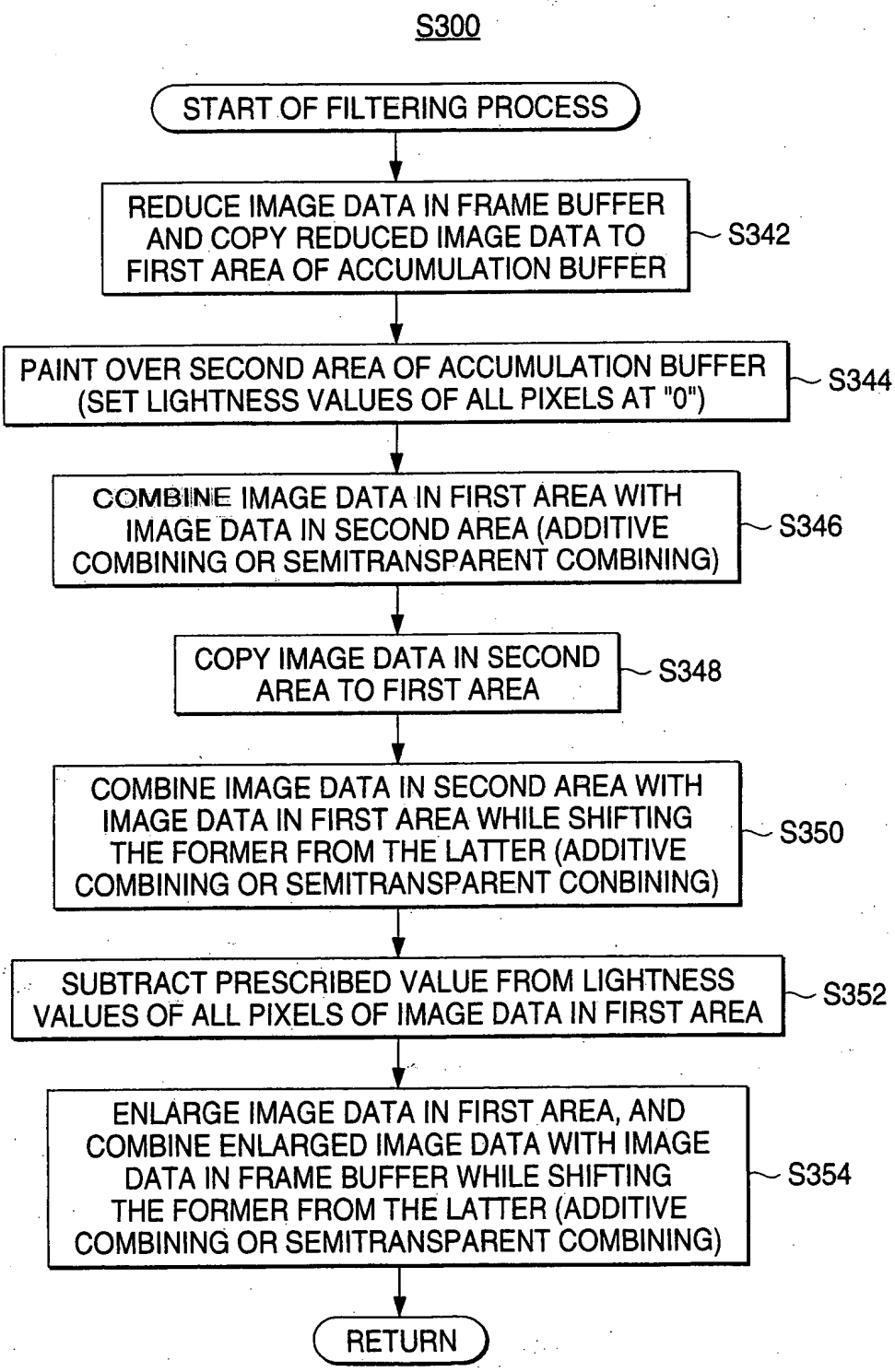
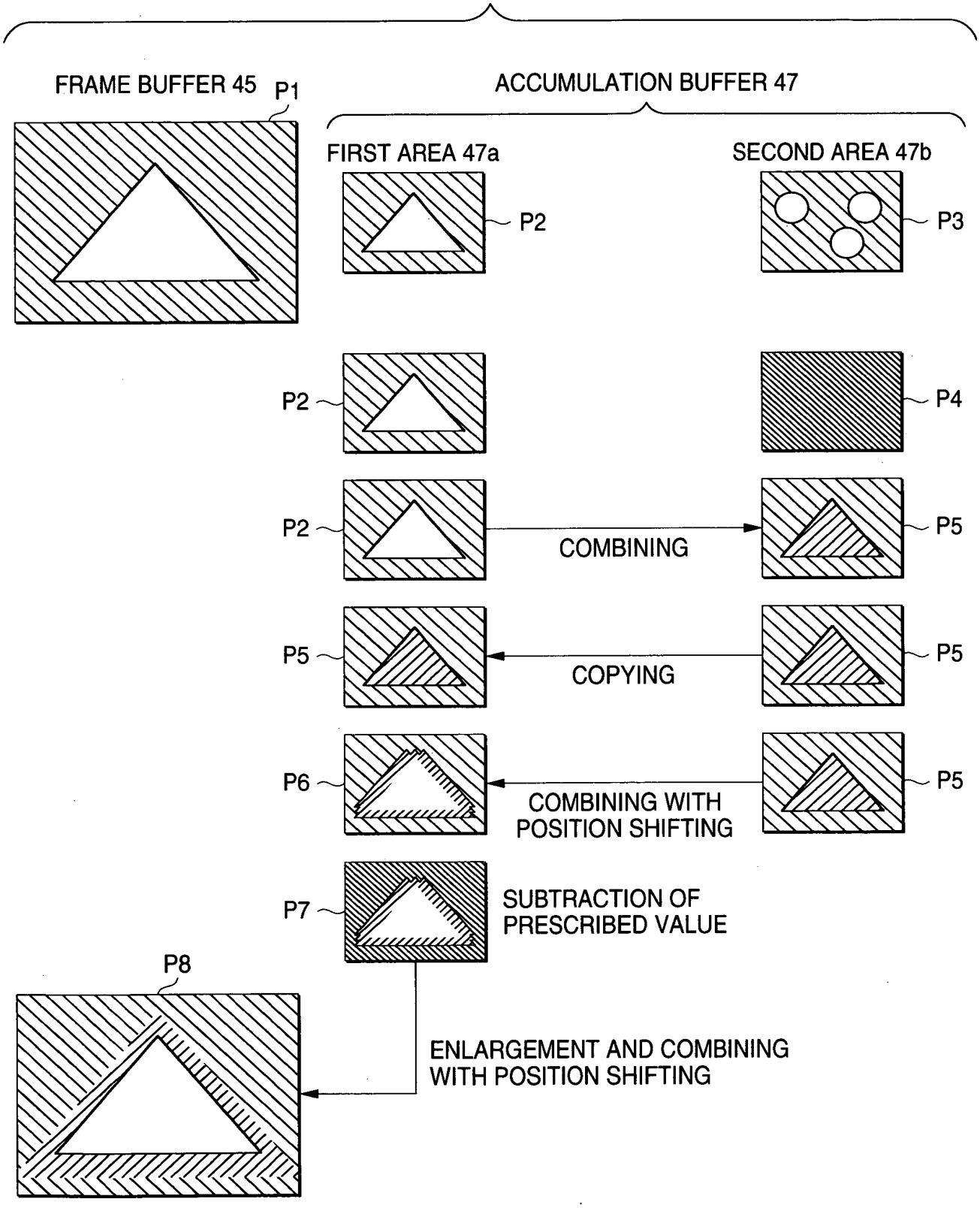

S300
START OF FILTERING PROCESS
REDUCE IMAGE DATA IN FRAME BUFFER AND COPY REDUCED IMAGE DATA TO FIRST AREA OF ACCUMULATION BUFFER
S342
PAINT OVER SECOND AREA OF ACCUMULATION BUFFER (SET LIGHTNESS VALUES OF ALL PIXELS AT "0")
S344
COMBINE IMAGE DATA IN FIRST AREA WITH IMAGE DATA IN SECOND AREA (ADDITIVE COMBINING OR SEMITRANSPARENT COMBINING)
S346
COPY IMAGE DATA IN SECOND AREA TO FIRST AREA
S348
COMBINE IMAGE DATA IN SECOND AREA WITH IMAGE DATA IN FIRST AREA WHILE SHIFTING THE FORMER FROM THE LATTER (ADDITIVE COMBINING OR SEMITRANSPARENT CONBINING)
S350
SUBTRACT PRESCRIBED VALUE FROM LIGHTNESS VALUES OF ALL PIXELS OF IMAGE DATA IN FIRST AREA
S352
ENLARGE IMAGE DATA IN FIRST AREA, AND COMBINE ENLARGED IMAGE DATA WITH IMAGE DATA IN FRAME BUFFER WHILE SHIFTING THE FORMER FROM THE LATTER (ADDITIVE COMBINING OR SEMITRANSPARENT COMBINING)
S354
RETURN

FIG. 19


FRAME BUFFER 45
P1
ACCUMULATION BUFFER 47
FIRST AREA 47a
SECOND AREA 47b
P2
P3
P2
P4
P2
COMBINING
P5
P5
COPYING
P5
P6
COMBINING WITH
POSITION SHIFTING
P5
P7
SUBTRACTION OF
PRESCRIBED VALUE
P8
ENLARGEMENT AND COMBINING
WITH POSITION SHIFTING

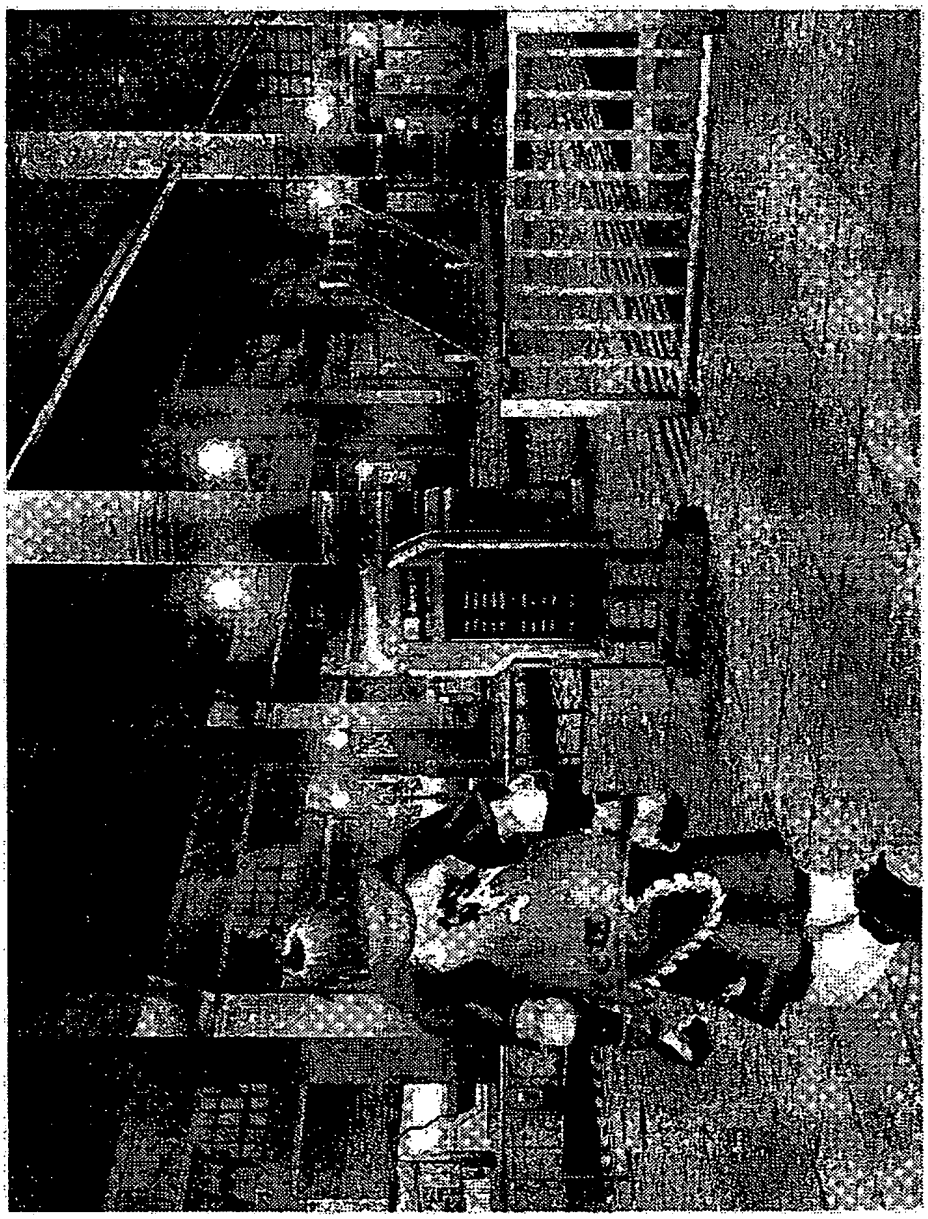


FIG. 20

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FIG. 21

FIG. 22

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